avoids identifying his formations with those of Europe, and contents himself with indicating such indefinite horizons as Lower and Upper Mesozoic. The list of publications on the mines and geological structure of Victoria is already a tolerably long one, and indicates no small amount of activity. It includes Mr. Smyth's work on the "Goldfields of Victoria," which we favourably noticed at the time of its appearance.

Easy-going geologists in this country, who spend their winters comfortably in town, and can at any moment transport themselves by train or steamer to even the farthest parts of the kingdom, have little notion what geologising is in an unexplored region like that of so vast a portion of Australia. Mr. Smyth, for instance, in the most matter-of-fact way refers to one part of geological work in Victoria as "cutting tracks," that is, levelling the trees and scrub in a densely-timbered region so as to make a roadway into the wilds. He truly adds that every mile of such road-cutting is a gain of so much territory to the colony. We find that during three months of last year the survey spent 172*l.* 16*s.* 6*d.* in cutting tracks, each of which was of course a geological section.

But while all this work is going on in his own colony, Mr. Smyth's energies extend over the whole of his continent. At his suggestion, representations have been made to the authorities of the other Australian colonies, to aid in the preparation of a general geological map embracing the whole of Australia and Tasmania. This proposal having been favourably received, considerable progress has been made in the preparation of the map. Mr. Smyth remarks however, that no response has been received from New South Wales, which still remains a blank on his map. No explanation is given of this not very intelligible statement. Certainly there is abundance of information to be had regarding the geological structure of that colony, where, among others, the veteran W. B. Clarke has laboured so long and so well.

As an illustration of the thoroughness with which the Department of Mines endeavours to do its work, it may be mentioned that specimens of rocks or minerals which may be sent up from any part of the country are examined, and if need be analysed, a boon which appears to be taken advantage of to a considerable extent. Appended to Mr. Smyth's Report of Progress is an excellent Report on the Mineral Resources of Ballarat, by R. A. F. Murray, who we believe was one of Mr. Selwyn's staff. The appendix contains also reports on some of the colonial coalfields. In conclusion, it should be added, that this Report is admirably, indeed almost luxuriously, printed and illustrated, presenting a very striking contrast to the blue-books we are accustomed to at home. Mr. Smyth deserves great credit for the way in which he has organised his work, and we trust that a long series of excellent reports may be obtained from him. ARCH. GEIKIE

THE FISHERIES OF NEW ENGLAND

Report on the Condition of the Sea Fisheries of the South Coast of New England in 1871 *and* 1872. By Spencer F. Baird, Commissioner. (Washington: Government Printing Office, 1873.)

WHILE the question of the supply of fish to the English markets is being year by year more anxiously discussed, and measures taken for the restoration of those fisheries which have been decimated, and for the protection of those whose productiveness is threatened by overfishing, our Transatlantic brethren are engaged in the investigation of a similar question in connection with the produce of their own waters. The wonderful fertility of fish, and the apparently inexhaustible supplies to be found in the waters of all parts of the world, have given rise to the idea that there is no limit to their abundance, and that no appreciable diminution in their numbers can be effected by the most unrestricted fishing. The experience afforded by the example of the salmon fisheries of this country has shown the fallacy of this idea. The most productive rivers have been reduced to absolute unproductiveness, and the most stringent measures have been adopted for encouraging the growth and restricting the destruction of fish. Overfishing, it is found, is not only possible, but has a very speedy effect on the natural supplies; and already the people on the other side of the Atlantic are experiencing the truth of this fact. Notwithstanding the enormous seaboard possessed by the United States, it is found that the supplies of fish are no longer equal to the demand, and the most important fish-producing States have consequently instituted inquiries with the view of adopting remedial measures. Opinions on no subject are more varied and contradictory than on the question of fish supplies. This is inevitable, as comparatively little is known of the habits of fish, and persons are too apt to generalise upon the result of their own limited experience. Finding the testimony of various authorities too conflicting to be of any use, the State of New England appointed Prof. Baird, of the Smithsonian Institution, to make a detailed inquiry into the condition of the fisheries on the coast and lakes of the country generally. The present report is the result of his first year's operations.

Anyone conversant with the fisheries of this country cannot fail to be struck with the similarity that exists between their condition and that of the American fisheries. The river fisheries of England had long been falling into decay, and were almost annihilated, when measures were adopted for their restoration. The river fisheries of America have also fallen off in productiveness, the only astonishing feature being the suddenness of this decay. There are many causes, such as the existence of pollutions, of obstructions, and of navigation, that have militated against the fisheries of this country which have not had equal force in America; but the principal cause of decay has acted more speedily there, and it is apparent that overfishing, and the destruction of spawning fish, have been on both sides of the Atlantic the chief enemy to the continued prosperity of river fisheries. Here salmon, there bass, have been trapped both in their upward and downward progress in the rivers, and no "close season" has been allowed in which they might, unmolested, perform their natural functions of reproduction. In England "fixed engines," *i.e.* devices fixed in the run of the fish, and intercepting almost every individual that would attempt to pass them, have been abolished. In America these instruments are more largely used than ever they were here; and a glance at the diagrams presented by Mr. Baird shows their terribly destructive nature. In some rivers, and on some parts of the coast, they are placed so thickly that no fish can pass

them ; and, as they are *in situ* all the year round without intermission, it is no wonder that the fisheries are decreasing in value. The total abolition of these engines is suggested as the only real remedy. But the Commissioner is afraid that such a regulation would entail great loss on the owners of such instruments, and would also suddenly interfere with the supply of fish to the public. These traps can fish without human help, while the more legitimate fishermen's nets and gear can only be employed in suitable weather. He recommends that an interval of sixty hours every week should be enforced, during which the use of traps and pounds should be absolutely interdicted ; that an annual close time of fifty-six days, viz. from April 20 to June 15, should be established, during which the use of such engines should be prohibited ; and that the licensing system adopted in England should be introduced.

This is certainly a step in the right direction, but we venture to think that a diminution in the number of fixed engines would be advisable, and that such diminution should be partially enforced at once, and be gradually continued till the whole of these instruments are abolished. This need entail very little hardship on individuals, and would certainly not interfere with the regular supply of fish to the markets, while the eventual increase would more than justify the enactment.

In regard to the more purely sea fisheries, the similarity between the British and American fisheries is equally striking, while at the same time the rapidity with which the produce of American waters has fallen off is still more marked. On the English coasts the fisheries are continually fluctuating, but in no part does the diminution in the capture appear to have been so great and so permanent as it is recorded to be in America. The curious extracts from works of two hundred years ago testify to the great natural abundance of fish in the seas adjoining to the American shores ; and, to come to more recent years, the printed evidence of living fishermen clearly shows that, for some reason or another, the sea fisheries, like the river fisheries, are much less valuable than they were thirty years ago.

The principal fishes of the coast to which the volume more particularly refers are the "blue fish" (*Pomatomus saltatrix*), also called "horse-mackerel ;" the "scup" (*Pagrus* or *Stenotomus argyrops*), "squeteague" (*Cynoscion regalis*), a species of bream ; "menhaden" (*Brevoortia menhaden*), a species of herring ; sea bass and striped bass (*Roccus* or *Labrax lineatus*) ; mackerel (*Scomber scombrus*), similar to the common European mackerel ; "tautog" or black fish (*Tautoga americana*), of the *Labridæ*, or wrasse family ; herring (*Clupea harengus*), and cod, both of the well-known species. Of these, the principal diminution has been found to have occurred among the blue fish, the bass, the scup, and the tautog. The former of these is a very voracious fish, rivalling the shark in its powers of destruction, so much so that to its agency has been ascribed the diminution of other kinds of fish in localities where it is generally caught. But since it has itself greatly diminished, it is hardly possible that the decrease of other fish is attributable in any degree to the depredations of one predaceous kind.

Besides the above there are many other kinds of fish, more or less valuable as food, and sought after also on account of the oil they yield, and for the purposes of utilising them as manure, a complete list of which is given by Prof. Baird. This list is most valuable as condensing and correcting the various imperfect catalogues that have from time to time been made, and as exemplifying the natural richness and fertility of the seas on the seaboard of the Eastern States. As an instance of the extreme difficulty of accounting accurately for the increase and diminution in the capture of fish, we may quote the unexpected appearance of a species of Tunny, a kind of small horse-mackerel (*Orcynus thunnina*), which, though never previously recorded as having been caught on the American coast, was found in great abundance in Menemsha Bight by the Commissioner. The movements of fish are far more difficult to watch and to account for than those of land-animals, and great difficulty is experienced in following them. On some occasions a certain kind of fish has been very abundant in one locality, while a short distance away it has been very scarce ; and one fishing-ground has been deserted one year, to be visited by large numbers the next year. One fallacy concerning the movements of the American migratory fish seems quite exploded. To quote Prof. Baird :—

"It was formerly supposed that certain fish, as the herring, the shad, and the alewives, with others of like habits, prosecuted an extensive migration along the shores of the ocean, covering, sometimes, thousands of miles in the sweep of their travels ; and much eloquent writing has been expended by such authors as Pennant and others in defining the starting-point and terminus, as well as the intermediate stages of the voyage. The shad, too, which, as is well known, occupies all the rivers of the Atlantic coast from Florida to the Gulf of St. Lawrence, was thought to begin its course in the West Indies, and in an immense body, which, going northward, sent a detachment to occupy each fresh-water stream as it was reached, the last remnant of the band finally passing up the St. Lawrence, and there closing the course. We now, however, have much reason to think that in the case of the herring, the shad, the alewife, and the salmon, the journey is simply from the mouths of the rivers by the nearest deep gully or trough to the outer sea, and that the appearance of the fish in the mouths of the rivers along the coast at successive intervals, from early spring in the south to near midsummer in the north, is simply due to their taking up their line of march, at successive epochs, from the open sea to the river they had left during a previous season, induced by the stimulus of a definite temperature, which, of course, would be successively attained at later and later dates as the distance northward increased."

It seems pretty well established that, with the American migratory fish, which enter fresh water to spawn, as with the English salmon, the same individuals pass as nearly as possible to the same river, or at least to the same locality, and the same rule applies to their progeny—the young fry appearing to return to the river in which they were hatched.

Of these migratory fish the salmon has been well nigh exterminated, and the shad alone appears to keep up its numbers. Whether or not this is altogether owing to the exertions of the fish culturists, who have hatched artificially many millions of these fish and turned them into the various rivers, it would be rash to say positively ; but no doubt this means, and the erection of suitable fish-passes to enable the fish to surmount the weirs, have had a large part in effecting this result.

As regards the practical protection of fisheries, whether in sea or river, the case of the Americans is almost identical with our own; and the remedies to be adopted must be the same in both countries. As regards the scientific side of the question, relative to the habits and distribution of fish, there is much that is new and valuable in the Commissioner's report. Indeed, the greater share of the volume is devoted to such questions, and to the scientific classification, not only of fish proper, but of the various other forms of life found in the waters, and important as either providing food for the useful fishes or as preying upon them.

The various invertebrate animals which form the principal diet of fishes appear to exist in profusion, so that the scarcity of food-fishes cannot be attributed to the want of natural sustenance. Some of these animals which serve as a prey to fish when young, in their turn become aggressors when full grown. An interesting account is given of the destruction caused by various kinds of *Cephalopoda*, which commit great havoc amongst the schools of mackerel and herring. In attacking the mackerel "they would suddenly dart backward among the fish with the velocity of an arrow, and as suddenly turn obliquely to the right or left and seize a fish, which was almost instantly killed by a bite in the back of the neck with the sharp beaks;" and yet these same "squids," when young, themselves afford abundant and favourite food to fish.

The subject of sea-bottom is nowhere of such importance as where oysters exist, and Prof. Baird's researches on this point are most valuable. His remarks, which we have not space to quote in full, might be studied with advantage by those who are interested in oyster culture in England and in France.

Nearly 300 carefully executed engravings of the rare and more valuable forms of invertebrata conclude a volume of which but a faint outline has been given.

BALDWIN'S "IRISH FARMING"

Introduction to Irish Farming. By Thomas Baldwin, M.R.I.A., Superintendent of the Agricultural Department of National Education in Ireland, &c. (London: Macmillan & Co., 1874.)

IT is only by the spread of thorough technical education among our farmers that the most will ever be made of the comparatively small area which in these islands can be devoted to agricultural purposes; only by a scientific knowledge of the material with which he deals will the farmer be enabled to improve to the utmost the quantity and quality both of his crops and live stock. By careful selection and suitable feeding vast improvements have within recent years been made in the quality of the latter commodity, and by a scientific study of the various kinds of crops, of soils, and of manures, natural and artificial, rapid progress is being made in forcing "the earth to yield her increase" in greater and greater quantity and of richer and richer quality. No doubt as the reign of science becomes more and more universal, farming, like all other human pursuits, will be followed with more and more of skill founded on accurate scientific knowledge, and will become gradually less a matter of blind rule-of-thumb. In many instances this is the case in Great Britain and in Ireland even now, many of our farmers bringing to bear upon their pursuit a knowledge of the results of the most extensive and exact scientific investigation. It will be long before such an intelligent knowledge becomes universal, we fear; and meantime such manuals as Mr. Baldwin's are of use in spreading among farmers, large and small, who have had no technical training in their occupation, a knowledge, conveyed in popular language, of what can be attained by scientific or skilled farming.

The work comprehends much in comparatively small compass. It treats first of manures, and the necessity of their application to supply the waste in the land caused by cropping. Without going deeply into the chemical properties of soils and manures, it affords plain directions which the unscientific man can clearly understand and appreciate; and considering the general character of the large class which the author essays to enlighten, he has taken the most efficient method for attaining his purpose. His remarks on farmyard manure are just, but he might have expressed his preference for covered yards more strongly, as, besides other advantages, these preserve the manure from rain-water; and, where fodder is in plenty, the liquid is absorbed and utilised in a way which it cannot be to equal advantage when applied by itself. It is well ascertained that dung made in such yards is much richer than in ordinary yards, as from being gradually compressed by the treading of the cattle the ammonia cannot escape, nor any appreciable waste occur. The author's estimate of the quantity of the manure made from one cow in the year at twelve tons is certainly too great if quality as well as quantity is desired.

The second chapter is devoted to the culture and management of green crops and cereals, including potatoes, carrots, turnips, mangold, &c., and the ordinary corn crops. Specific directions are given as to what kinds to sow on particular soils, and how to manage them in the fields and in storing them, each variety being specially referred to in its comparative productiveness and utility. The author's remarks on hay-making are well worthy of perusal. There is no crop so mismanaged as this, especially in Scotland, and considering its extent and value, no censure can be too strong on the negligence and want of skill so generally manifested in securing it.

The third chapter is devoted to live stock, and here the author seems to have studied the various phases of breeding and fattening with a practical eye. Ireland is peculiarly well fitted for rearing stock, and the yearly supply it affords to Great Britain is marvellous. With a moist climate and an alluvial soil, the Irish farmers possess facilities in their fresh swards and luxuriant green crops which we do not possess on this side of the Channel; until at all events we go across the Tweed, and not even there in sufficient breadth and measure, for permanent grass meadows are seldom to be seen. The quality of the various breeds of cattle and sheep is discussed; but it must be remarked that a great complaint on this side of the Channel is made as to the want of quality and growth in much of the supply afforded us; this is no doubt owing principally to the careless selection of breeders, and to too much indiscriminate crossing. The author's remarks on poultry deserve special attention, not